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Morissette

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(54) **SELF-SUPPORTING PNEUMATIC HAMMER POSITIONER WITH UNIVERSAL JOINT**

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(51) **Int. Cl.**[7] **E21B 15/04**

(52) **U.S. Cl.** **173/38**; 173/31; 173/32; 173/36; 173/193

(58) **Field of Search** 173/38, 42, 44, 173/45, 192, 31, 32, 36, 193; 248/663, 651, 654

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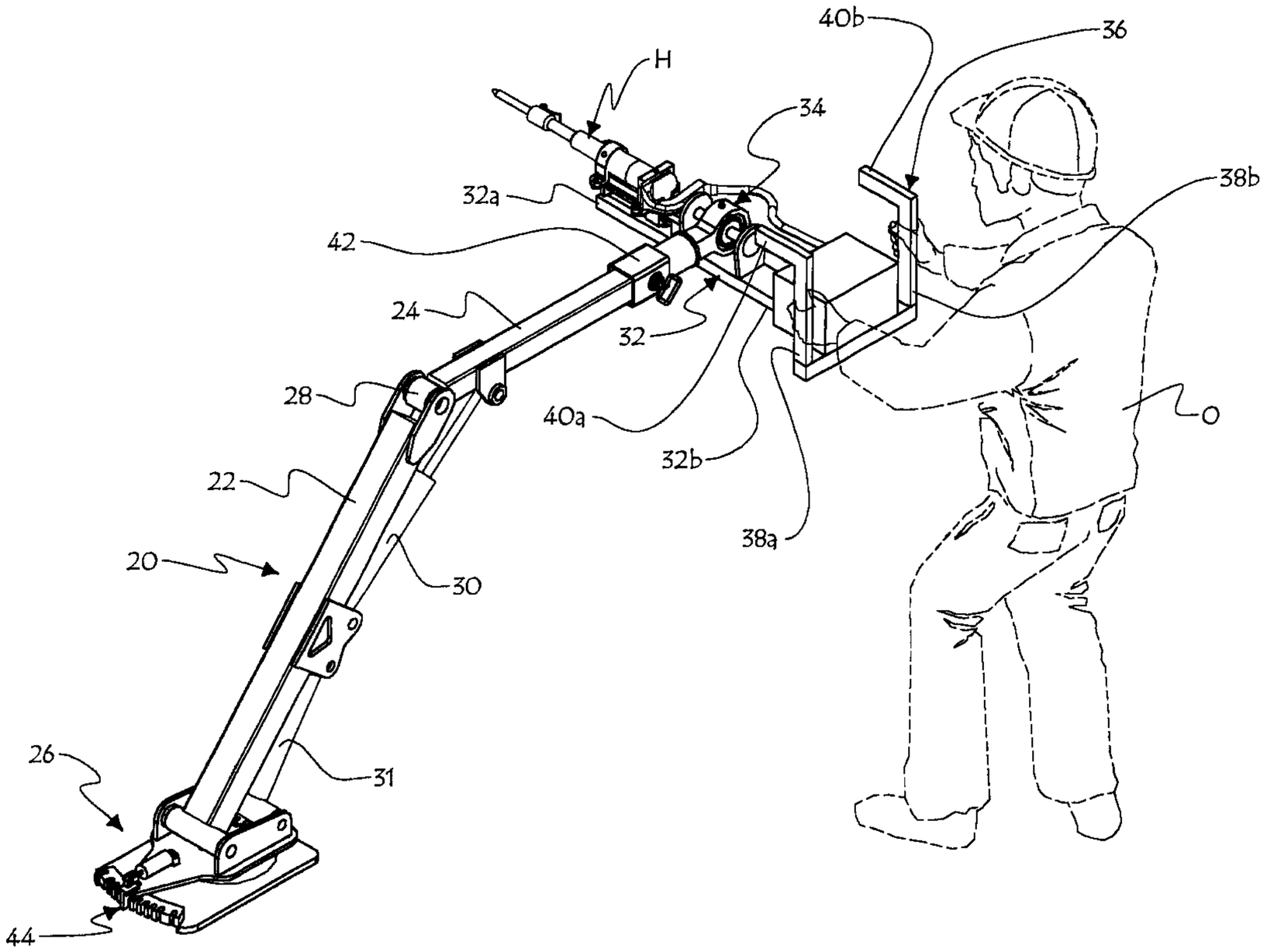
(57) **ABSTRACT**

A self-supporting pneumatic hammer positioner for effortless command and control by an operator of a pneumatic hammer. The positioner comprises a rigid elongated template having a handle at a first end portion thereof, a saddle mount for a pneumatic hammer at a second end portion thereof, and a 3-axes pivotal mount integral to an intermediate section of the elongated template. An articulated boom member is provided, having an inner end portion and an outer end portion, its inner end portion pivotally mounted to the 3-axes pivotal mount. The boom member outer end portion is pivotally mounted about a one-axis mount to a ground anchor base.

16 Claims, 10 Drawing Sheets



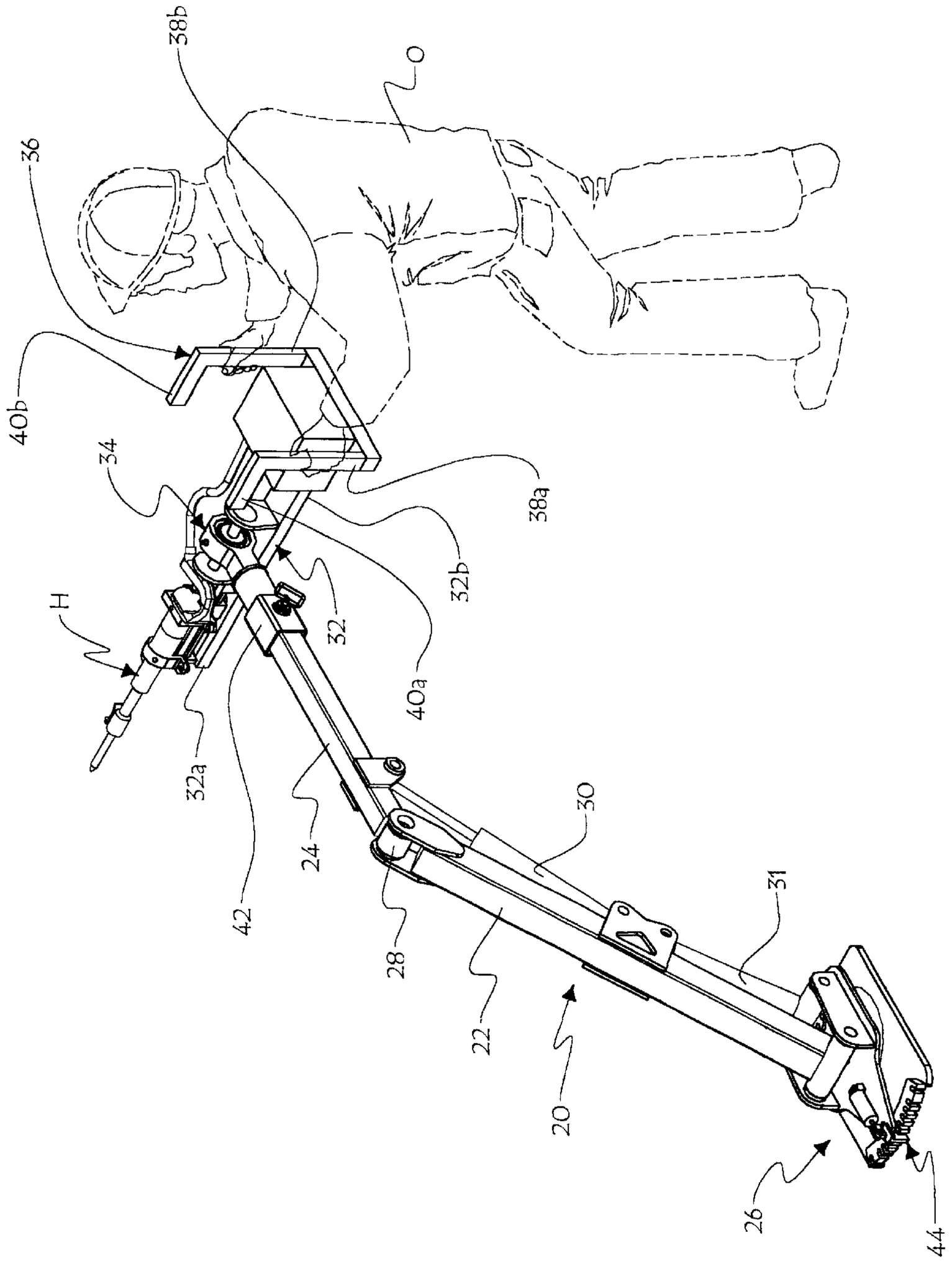


Fig.1

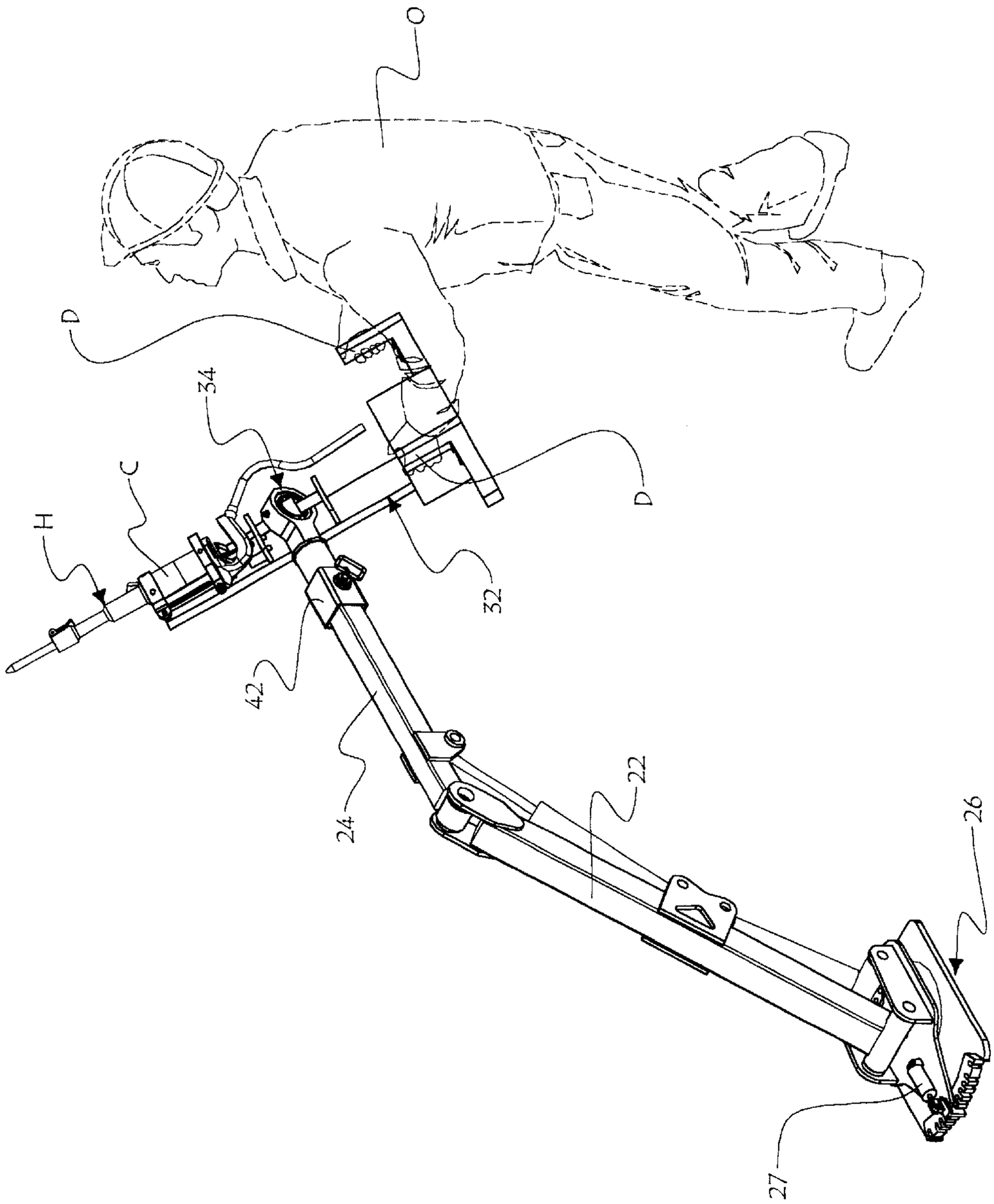


Fig.2

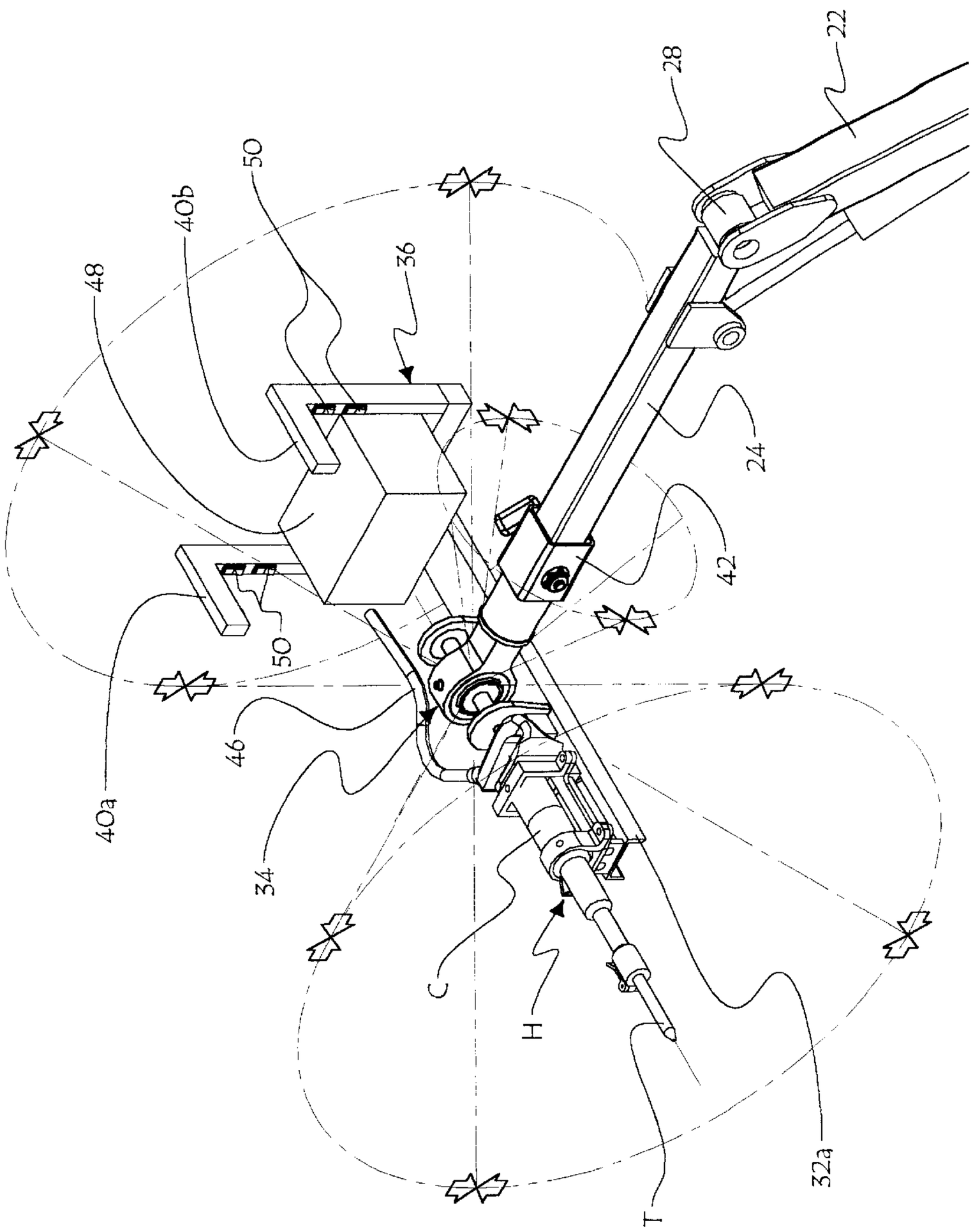


Fig.3

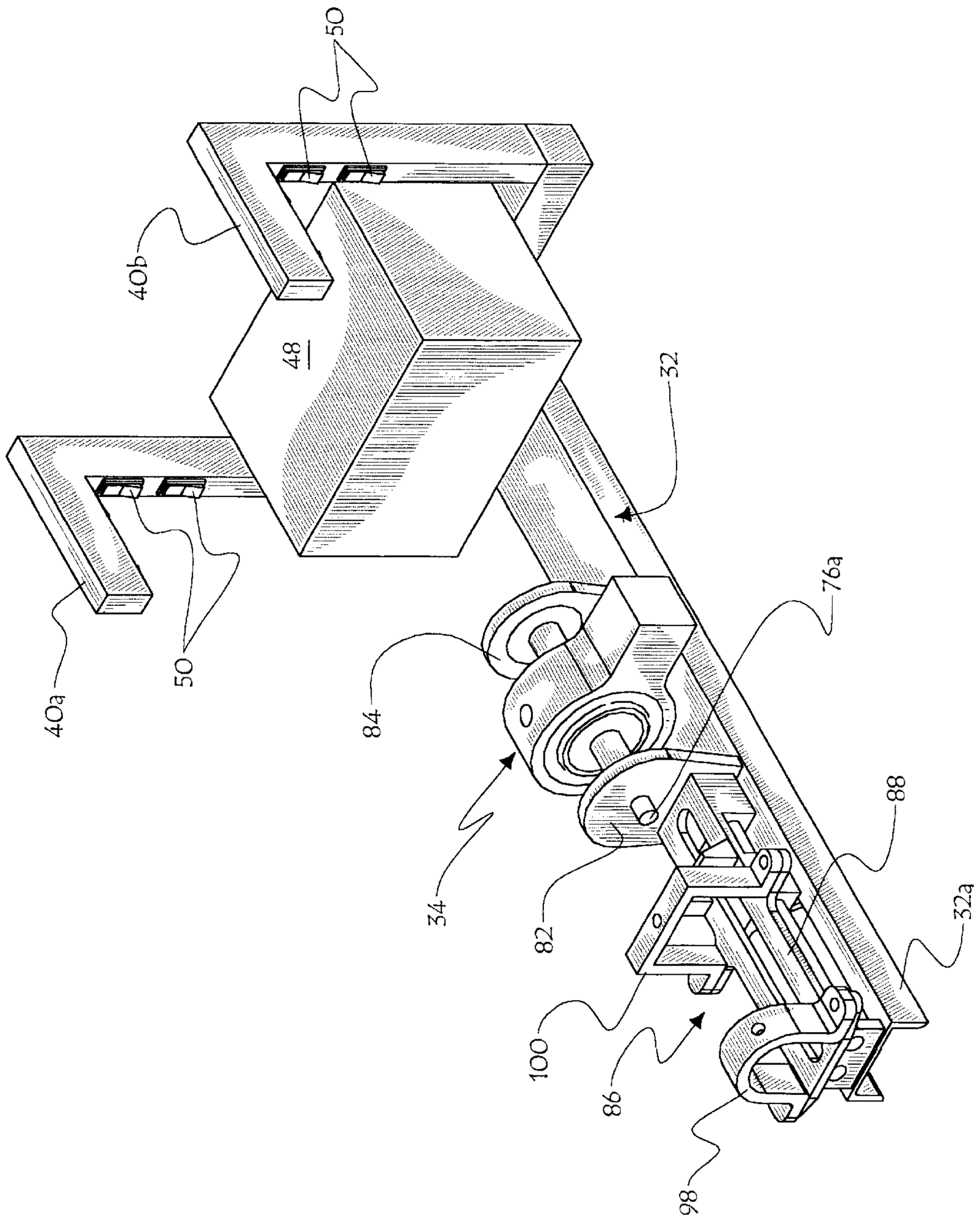


Fig.4

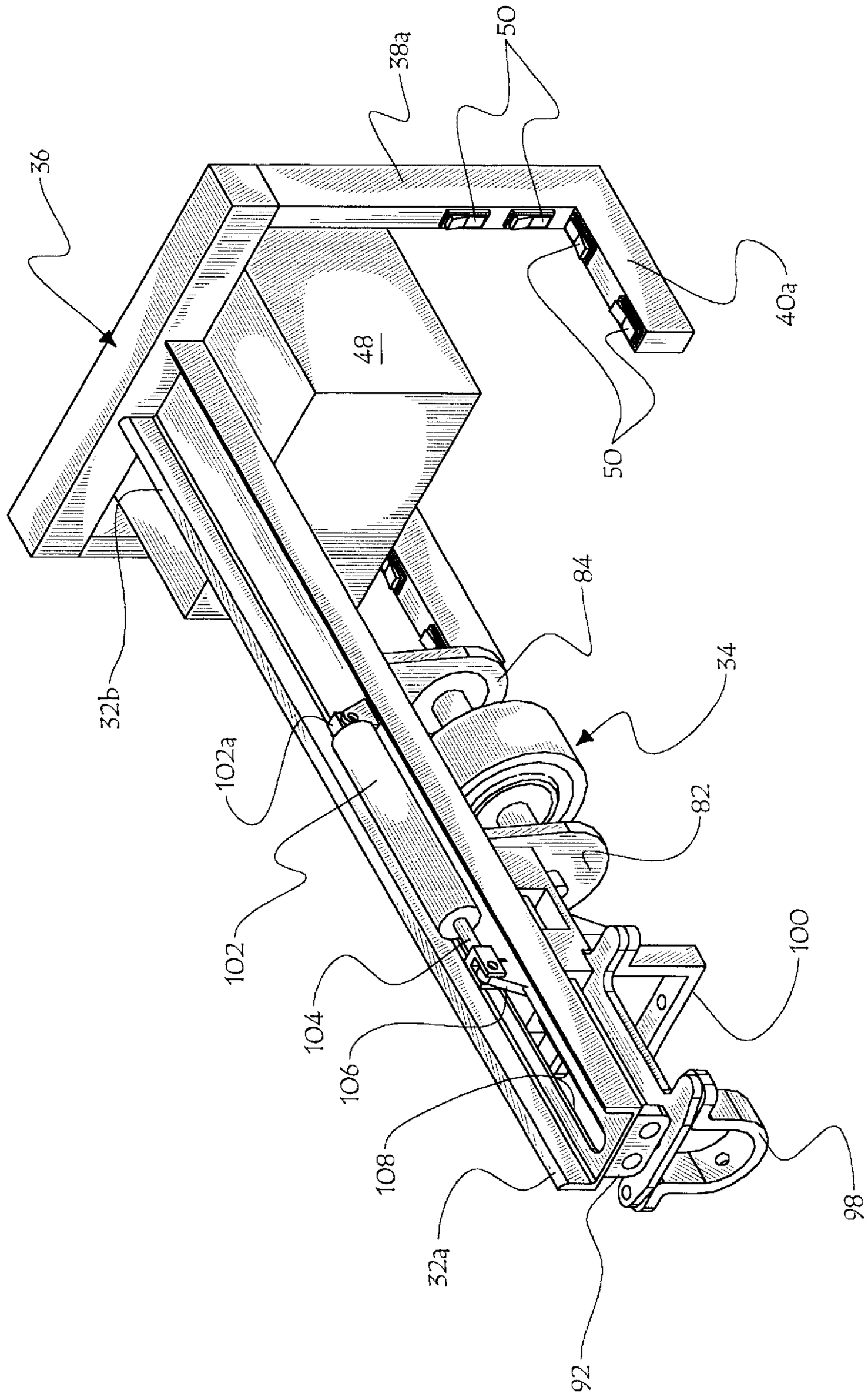


Fig.5

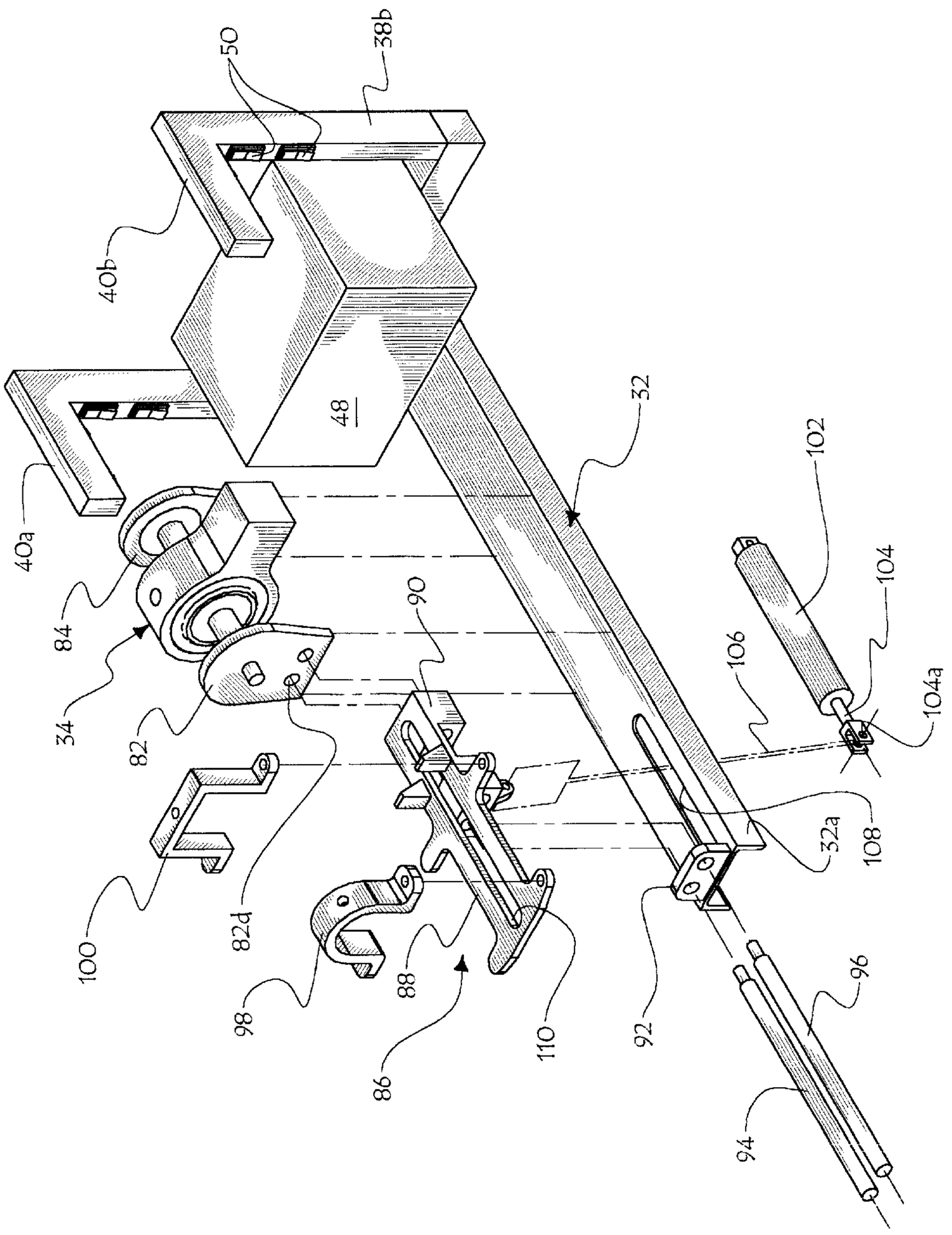

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Fig.6

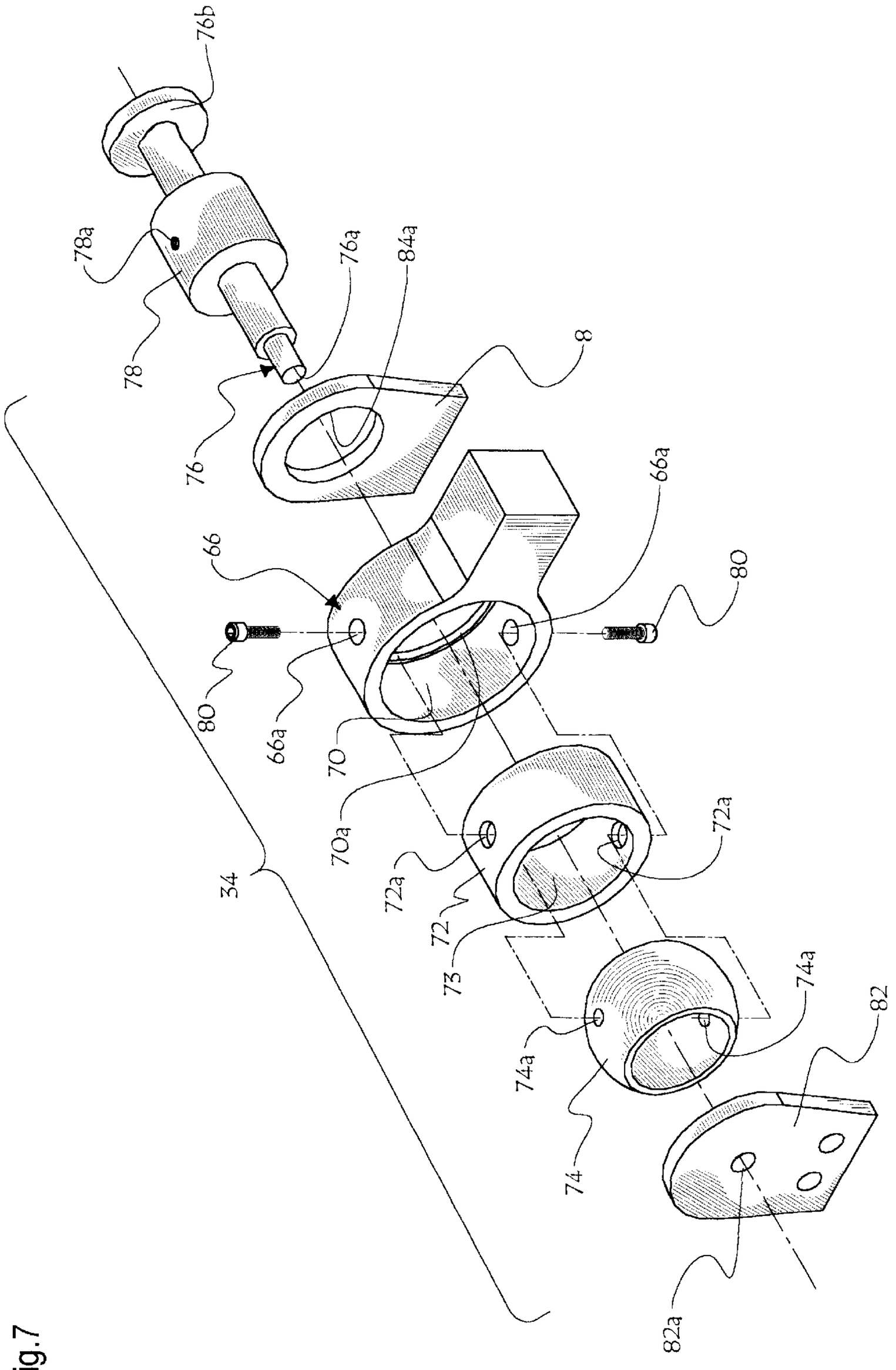
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Fig.7

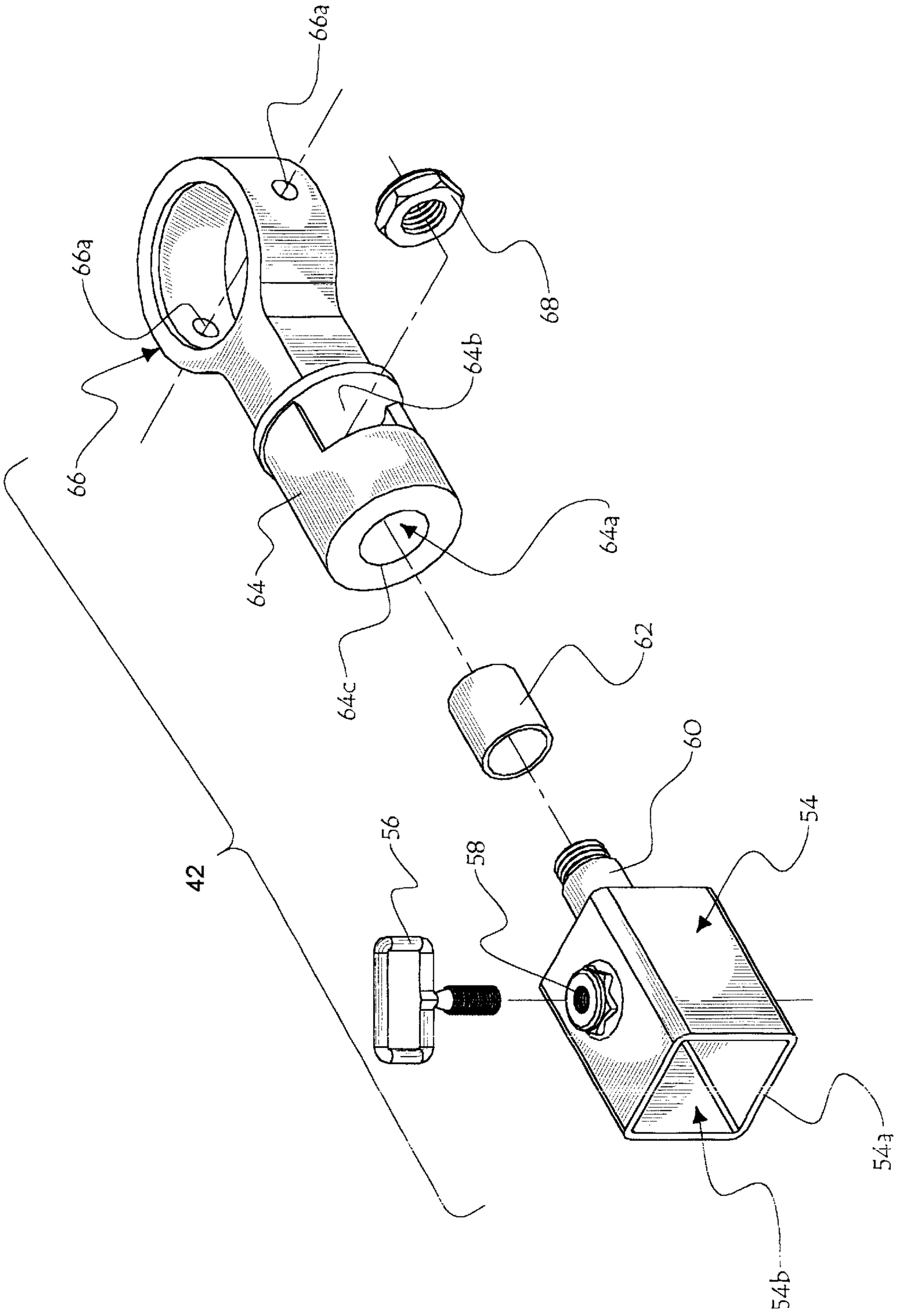

Fig.8

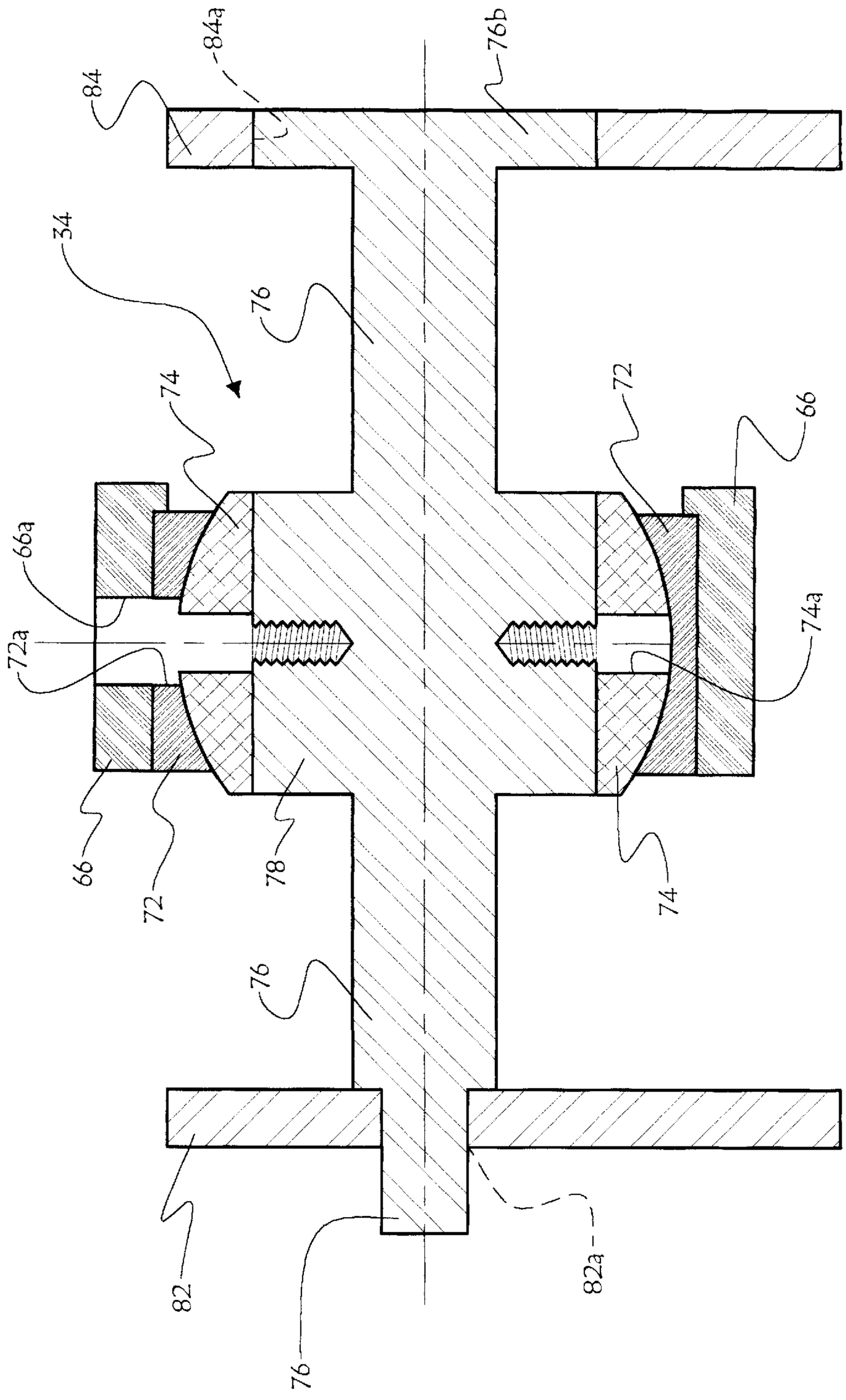

Fig.9

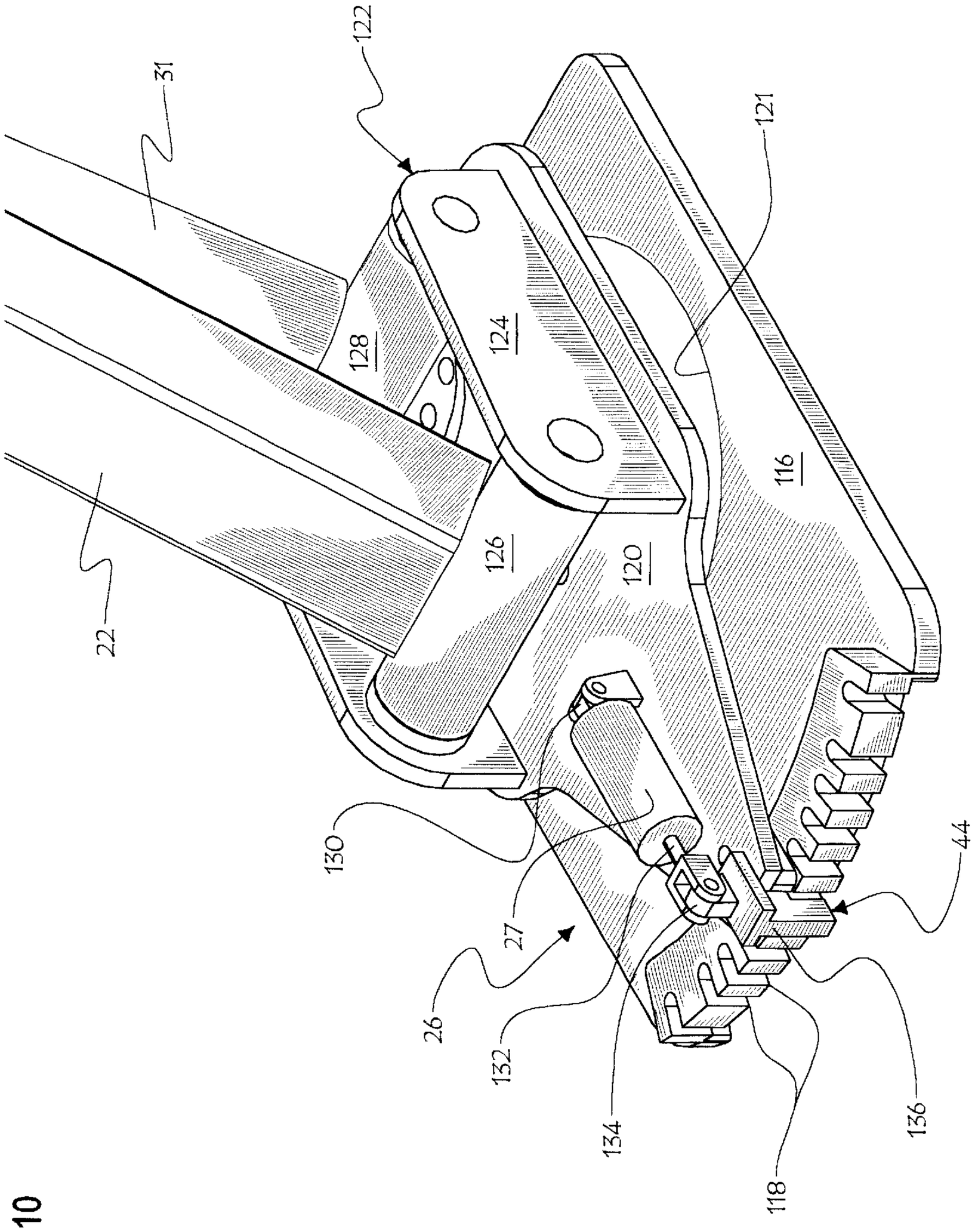

Fig.10

SELF-SUPPORTING PNEUMATIC HAMMER POSITIONER WITH UNIVERSAL JOINT

FIELD OF THE INVENTION

This invention relates to a suspending device for hand-held power hammers.

BACKGROUND OF THE INVENTION

In the construction industry, it is often necessary to make repairs to hard surface walls that are spaced over ground beyond arm's length. For example, maintenance repairs are periodically required on the superstructure of a motor vehicle highway overpass. This means that workers need to work from beneath, looking upwardly. Since some partial demolition of structure is required before repairs can be implemented, hand held power hammers form part of the required tools in this regard. Power hammers break concrete and other hard surfaces by the reciprocating motion of a hard tip tool. These power hammers are quite heavy, and can produce adverse medical conditions for the workers, induced by the hammer weight and vibrations produced by the operating hammer, for example the well known muscular tendinitis.

It is believed that there is a need for improvement and enhancement in the capabilities of existing suspending devices for hand held power hammers.

OBJECT OF THE INVENTION

The main object of the present invention is to improve upon suspending devices for hand-held power hammers, which makes it possible for the operator to command and control a hand-held power hammer without having to carry the weight of the hammer.

Another object of the invention is to provide a system to counteract the moment of force generated by a power hammer striking a work surface.

A further object of this invention is to improve upon productivity of power hammer operations.

SUMMARY OF THE INVENTION

In accordance with the object of the invention, there is disclosed a pneumatic hammer support member for mounting to a ground spaced end portion of an articulated boom, said support member having an elongated rigid frame, mounting means mounted at an intermediate section of said elongated rigid frame for relative 3-axes movement of said support member relative to the articulated boom, a saddle system for releasable attachment of a pneumatic hammer to an outer end portion of said rigid frame, and a handle member integrally mounted to an inner end portion of said rigid frame opposite said outer end portion thereof, said handle member for hand grasping by an operator; wherein the operator is able to manoeuver said support member in a loadless fashion.

Preferably, said mounting means could include a hemispheric socket, a spherical ball bearing rotatably mounted into said socket, a connector integral with said socket for operative connection with the articulated boom, a shaft having an intermediate portion extending through said ball bearing, and opposite bracket members anchored to said support member rigid frame and rotatively engaged by opposite ends of said shaft. Said socket and said ball bearing could form part of a self-alignment bushing assembly.

The invention also relates to the combination of an articulated boom having a pair of first and second arms

pivoted to one another about a one-axis boom inter-arm pivot mount, said first pivotal arm having an inner end fixedly mounted by a boom anchor mount to an anchor base, said second pivotal arm having an outer end, and a pneumatic hammer support member mounted to said outer end of said articulated boom second arm, said support member having an elongated rigid frame, mounting means mounted at an intermediate section of said elongated rigid frame for relative 3-axes movement of said support member relative to said articulated boom, a saddle system for releasable attachment of a pneumatic hammer to an outer end portion of said rigid frame, and a handle member integrally mounted to an inner end portion of said rigid frame opposite said outer end portion thereof, said handle member for hand grasping by an operator;wherein the operator is able to manoeuver said support member in a loadless fashion.

Preferably, said boom anchor mount includes means for relative one axis rotational movement of said boom first arm, and releasable lock means to counteract the moment of force generated by a power hammer striking a work surface.

The invention also relates to a self-supporting pneumatic hammer positioner for effortless command and control by an operator of a pneumatic hammer, said positioner comprising:—a rigid elongated template having a handle at a first end portion thereof, a saddle mount for a pneumatic hammer at a second end portion thereof opposite said first end portion thereof, and a 3-axes pivotal mount integral to an intermediate section of said elongated template intermediate said first end portion and said second end portion thereof;—an articulated boom member having an inner end portion and an outer end portion, said inner end portion pivotally mounted to said 3-axes pivotal mount;—an anchor base, said boom member outer end portion pivotally mounted about a one-axis mount to said anchor base.

A lock member could then be releasably mounted to said anchor base to counteract the moment of force generated at said boom member outer end portion relative to said anchor base, when the generated hammer strikes a work surface.

Said saddle mount could include:—a carriage, slidingly mounted over said second end portion of said template;—guide means, guiding said carriage for travel between first and second limit positions;—ram means, for biasing said carriage to slide to an extended operative condition intermediate said first and second limit positions and—attachment members, anchored to said carriage for releasably anchoring the pneumatic hammer to said carriage. A self-alignment bushing assembly could form part of said 3-axes pivotal joint assembly.

Preferably, the hammer positioner could further include:—second ram means, for power assist pivotal displacement of said articulated boom member; and—third ram means, for power assist rotation of said template relative to said articulated boom member.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the pneumatic hammer power assist support device and associated ground standing articulated positioning arm, with an operator in phantom lines operating the pneumatic hammer in a horizontal direction;

FIG. **2** is a view similar to FIG. **1**, but with the pneumatic hammer being operated in an upwardly outwardly inclined direction;

FIG. **3** is a schematic partial view of the present support device, suggesting the omni-directional play afforded by the universal joint forming part of the pneumatic hammer support device;

FIGS. **4** and **5** are perspective views at an enlarged scale of the pneumatic hammer support device, rotated by half a turn relative to one another;

FIG. **6** is an exploded view of the upper portion of pneumatic hammer support device from FIG. **4**;

FIG. **7** is an exploded view at an enlarged scale of the universal joint assembly forming part of the pneumatic hammer support device;

FIG. **8** is an exploded view of the pivotal joint assembly interconnecting the pneumatic hammer support device and the ground standing articulated positioning arm;

FIG. **9** is a cross-sectional view at an enlarged scale of the universal joint assembly of FIG. **6**; and

FIG. **10** is an enlarged perspective view of the ground foot member from the articulated positioning arm.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. **1–3** show how the present invention can be handled by an operator O. A positioning articulated boom **20**, defining a lower arm **22** and an upper arm **24**, is pivotally mounted by its lower arm **22** to the ground by a vertical one-axis pivotal foot mount **26**. Lower arm **22** is also tiltable at its lower end portion, under power from ram **31** (detailed hereinbelow). Ram means **27**, detailed later, releasably lock boom **20** against rotation relative to foot **26**. Both arms **22** and **24** are pivoted to one another about a horizontal one-axis pivot mount **28**. Ram means **30**, **31**, provide power assist to arms **22** and **24** respectively relative to ground foot mount **26**. Ram means **30**, **31**, each includes an integral lock valve, to maintain the interconnected structures to their selected relative position. An elongated support **32** is further provided, having at an intermediate section thereof a three-axes universal joint assembly **34**, and carrying at a fore end thereof **32**A a pneumatic hammer H. The rear end **32**B of elongated support **32**, opposite fore end **32**A, includes an integral U-shape handle **36**. Preferably, each of the two side legs of U-shape handle **36** forms an integral L-shape as shown, defining upright legs **38**A, **38**B and two forwardly directed legs **40**A, **40**B.

The operator O may grasp with his hands D either the upright legs **38**A, **38**B, when working generally horizontally against a vertical wall surface with the hammer H as shown in FIG. **1**, or the forward legs **40**A, **40**B, when working in an inclined fashion against a generally horizontal (or generally inclined) overlying wall surface with the hammer as shown in FIG. **2**. Universal joint assembly **34** is connected to the outer end of the boom upper arm **24** by a connector **42** provided with a one axis axial rotational mount. With the analogy of a human arm (**20**), pivot **28** is the elbow and universal joint assembly **34**, the wrist.

As shown in FIG. **8**, connector **42** includes a socket **54**, having a mouth **54**A opening into a hollow **54**B. Socket hollow **54**B is complementarily shaped to the outer end portion of boom arm **24**, for frictional engagement therein. A bolt **56** engages through a bore **58** in the wall of the socket **54**, and through a corresponding bore (not shown) at an end portion of arm **24**, and frictionally engages the registering section of boom arm **24** to keep it in place and to prevent accidental release therefrom. Socket **54** includes an axial projecting threaded shaft **60**, freely engaged by a sleeve **62**.

The hollow **64**A of housing **64** receives the combined shaft **60** and surrounding sleeve **62**. Housing **64** is anchored by welding to the casing **66** of corresponding ball and socket joint **34** by a nut **68**, screwed in place into a connector recess **64**B made in housing **64** opposite mouth **64**C of hollow **64**A. Accordingly, housing **64** and casing **66** can rotate together relative to the socket **54**.

FIGS. **7** and **9** show the various components of the universal joint **34** of the present invention. The casing **66** includes a recessed aperture **70**. A cylindrical collar **72** with a hemispheric hollow **73** receives therein a spherical ball **74**. The ball **74** is mounted inside collar **72** for free rotation in all directions, but ball **74** is trapped inside hollow in that it cannot escape unless collar **72** is broken. Such an assembly of ball **74** rotatably trapped inside a socket **72** is called a "self-alignment bushing".

Collar **72** is complementarily shaped with recessed aperture **70**, so that friction fit interlock occurs when collar **72** fully engages into housing **66**. Recessed aperture **70** includes a radially smaller shoulder **70***a* at one edge thereof, against which snugly abuts collar **72**. Collar **72** becomes trapped inside housing **66**, and cannot move within the hollow **73** of housing **66**, and so collar **72** and housing **66** become integral to one another.

A joint shaft **76** extends through joint components **66**, **72**, **74**, with a radially enlarged intermediate section thereof **78** fitting snugly within the hollow of ball **74**. A few socket cap screws **80**, **80**, interlock shaft enlarged portion **78** and ball **74**, through threaded bore **78***a* and counter bore **74***a*, respectively, so that shaft **76** and **74** move integrally in unison. Enlarged access ports **72***a*, **66***a*, are provided on collar **72** and housing **66**, respectively, to enable Allen key (or the like tool) access to the head of the cap screws **80** on shaft portion **78** and ball **74**, whenever needed.

Attachment brackets **82**, **84**, are mounted on opposite sides of ball and socket joint assembly **66**, **72**, **74**, **76**. Bracket member **82** has a small bore **82***a* for free passage of joint shaft inner end portion **76***a*, while bracket member **84** has a large bore **84** to accommodate passage of enlarged portion **78** of joint shaft **76**. The joint shaft outer end portion **76***b* forms a radially enlarged disk.

Joint components **66**, **72**, **74**, **76** are therefore all carried by support bar **32**.

The size of shaft **76–78**, the distance between the two attachment brackets **82**, **84**, and the size of ball **74** determine the amplitude of movement in space of the hammer support **32**.

FIGS. **4–6** show the saddle assembly **86** for attachment of the hammer H to the outer end portion **32**A of support bar **32**. Saddle assembly **86** includes a carriage **88**, slidably mounted over bar end portion **32**A. Carriage **88** includes a transverse downturned bored flange **90**, at an inner end thereof, and bar **32** includes an upturned bar flange **92**, wherein a pair of elongated guide rods **94**, **96**, engage at their opposite end portions flanges **90** and **92**, respectively and a pair of additional bores **82**D, **82**D, respectively, of bracket **82**. Guide rods **94**, **96**, guide displacement of carriage **88** slidingly parallel over end portion **32**A and retain carriage **88** thereon. A pair of saddle members **98**, **100**, of a shape complementary to the main cylinder housing C of hammer H, fixedly anchor the latter to the respective opposite ends of sliding carriage **88**. A pneumatic ram **102** is anchored at an inner end **102**A to an intermediate portion of underface of template **32**. A bracket **104**A carried at the outer end of the piston rod **104** of ram **102**, is transversely connected by a link arm **106** to hammer H, through ovoïdal slot **108** , made in registering portions of bar portion **32**A and carriage **88**, respectively.

Control box **48** shown for example in FIGS. **4–6**, includes therein a first electropneumatic valve, which controls the

ground base ram **27**, a second electropneumatic valve, which controls the carriage displacement ram **102**, a pneumatic valve which feeds pressurized air fluid to the operating hammer H, a time delay circuit, a pressure regulator for carriage ram **102** to adjust the push bias of the hammer H against the work surface, and a support electrical circuitry. This suppot electrical circuitry is in turn connected to hydraulic valves (not shown) which are located at the lower end of boom **22**, and these latter valves feed in turn rams **30** and **31**. Alternately, the control unit **48** could be done without and each hydraulic ram could be independently actuated manually, in a non electrical fashion, for example with a dedicated mechanical joystick.

Foot **26**, best illustrated in FIG. **10**, includes a ground engaging plate **116** having a number of notches **118** along an edge portion thereof. A swivel pad **120** with turntable bearings **121** is pivotally mounted flatly against ground plate **116**, for pivotal motion about a vertical axis. A pivotal assembly **122** is anchored to swivel pad **120**. Pivotal assembly **122** includes a frame **124** having two parallel pivot axles **126**, **128**, extending orthogonally to the vertical pivot axis of swivel pad **120**. The lower end of boom arm **22** is anchored to pivot axle **126**, and the lower end of ram **31** is anchored to pivot axle **128**. Ram **127** is anchored at its cylinder end to a pivotal bracket **130**, anchored to swivel pad, with the axis of pivot mount **130** parallel to pivot axles **126** and **128**. The outer end of the piston rod **132** of ram **27** carries a pivotal bracket **134**, to which is anchored an indexing finger **136**. Finger **136** is adapted to selectively register with one of the notches **118** of ground plate, when piston rod **132** is extended from ram **27**, once piston rod **132** is retracted into ram **27**. The air pressurisation constantly biases piston rod **132** to a selected lock position inside a notch **118**, to counteract the moment of force generated by the power hammer H when striking a work surface.

As shown in FIGS. **2–3**, the hammer tool T at the outer end of hammer H, extends generally parallel to support bar **32** and in a direction opposite operating handle **36**. Tool T is adapted to conventionally strike a work surface, during operation. Pneumatic power is fed to the cylinder C, for sliding hammer H, including integral cylinder C, over support bar **32** backwardly, when not in use, or forwardly, when in use, via pneumatic line **46** connected to a pneumatic fluid source (not illustrated). Electrical control of all elements of the present invention is actuated via knobs **50** mounted to the legs of the handle **36**. Knobs **50** control at least one of the following:

a) the energizing of the hammer tool T;

b) the sliding fore and aft displacement of the hammer H;

c) the 1-axis pivotal motion of upper boom arm **24** relative to lower boom arm **22**;

d) the 1-axis pivotal motion of lower boom arm **22** relative to ground foot **26**.

e) the control of cylinder **27** on base **120**.

In operation, operator O first sends commands by knobs **50** to hydraulic rams **30** and **31** and to pneumatic cylinder **27**, to pivot boom arms **22**, **24** and rotate about ground pivot assembly **122**, so as to bring the hammer H relatively close to the work surface area, in a coarse positioning fashion. Then, operator O manually pushes U-shape handle **36** to manoever support member **32** about joints **42** and **34**, to provide further fine tuning in the orientation of the hammer H relative to the selected area of the work surface to be demolished. After that, operator O sends third commands by knobs **50** so that pneumatic ram **102** push piston rod **104** forward, to bring the hammer tool T in engaging contact with the work surface area . Only then is the hammer H energized to demolish the work surface. Ram **102** maintains its pressure on the hammer tool T so that the tool T remains constantly biased against the work surface, the work surface area becomes fragmented and progressively disintegrates. When hammering work is completed, the operator O sends a final command by knobs **50** to de-energize the hammer H and withdraw piston **104** into ram **102**, i.e. to pull out hammer carriage **88** .

The present hammer support and positioner enables a worker to strike with the hammer tool at work surfaces which are vertical, horizontal or even inclined. Tools other than pneumatic hammers could interchangeably benefit from this self-supporting system, for example, an electric drill, a fluid hose, a firefighter water hose, or other heavy tools which must be handled by an operator with some precision required in targeting. Although mounting to a ground base **116** has been shown in the drawings, other types of mounting are not excluded. For example, one could pivotally mount joint **42** to a basket, (not shown) wherein arms **24**, **22** and base **26** are therefore not needed and removed.

I claim:

1. A pneumatic hammer support member for mounting to a ground spaced end portion of an articulated boom, said support member having an elongated rigid frame, mounting means mounted at an intermediate section of said elongated rigid frame for relative 3-axes movement of said support member relative to the articulated boom, a saddle system for releasable attachment of a pneumatic hammer to an outer end portion of said rigid frame, and a handle member integrally mounted to an inner end portion of said rigid frame opposite said outer end portion thereof, said handle member for hand grasping by an operator;

wherein the operator is able to easily handle said support member.

2. A support member as in claim **1**, wherein said mounting means includes a hemispheric socket, a spherical ball bearing rotatably mounted into said socket, a connector integral with said socket for operative connection with the articulated boom, a shaft having an intermediate portion extending through said ball bearing, and opposite bracket members anchored to said support member rigid frame and rotatably engaged by opposite ends of said shaft.

3. A pneumatic hammer support member as in claim **2**, wherein said socket and said ball bearing form part of a self-alignment bushing assembly.

4. A pneumatic hammer support member as in claim **1**, wherein said saddle system includes:

a carriage, slidingly mounted over said outer end portion of said rigid frame of said support member;

guide means, guiding said carriage for travel between first and second limit positions;

ram means, for biasing said carriage to slide to an extended operative conditions intermediate said first and second limit positions thereof; and

attachment members, anchored to said carriage for releasably anchoring the pneumatic hammer to said carriage.

5. In combination, an articulated boom having a pair of first and second arms pivoted to one another about a one-axis boom inter-arm pivot mount, said first pivotal arm having an inner end fixedly mounted by a boom anchor mount to an anchor base, said second pivotal arm having an outer end, and a pneumatic hammer support member mounted to said outer end of said articulated boom second arm, said support member having an elongated rigid frame, mounting means mounted at an intermediate section of said elongated rigid

frame for relative 3-axes movement of said support member relative to said articulated boom, a saddle system for releasable attachment of a pneumatic hammer to an outer end portion of said rigid frame, and a handle member integrally mounted to an inner end portion of said rigid frame opposite said outer end portion thereof, said handle member for hand grasping by an operator;

wherein the operator is able to easily handle said support member.

6. A combination as in claim **5**, wherein said boom anchor mount includes means for relative one axis rotational movement of said boom first arm, and releasable lock means to counteract the moment of force generated by a power hammer striking a work surface.

7. A combination as in claim **5**, wherein said mounting means includes a hemispheric socket, a spherical ball bearing rotatably mounted into said socket, a connector integral with said socket and operative connected with said articulated boom outer arm, a shaft having an intermediate portion extending through said ball bearing, and opposite bracket members anchored to said support member rigid frame and rotatively engaged by opposite ends of said shaft.

8. A combination as in claim **7**, wherein said socket and said ball bearing form part of a self-alignment bushing assembly.

9. A combination as in claim **5**, wherein said saddle system includes:

a carriage, slidingly mounted over said outer end portion of said rigid frame of said support member;

guide means, guiding said carriage for travel between first and second limit positions;

ram means, for biasing said carriage to slide to an extended operative conditions intermediate said first and second limit positions thereof; and

attachment members, anchored to said carriage for releasably anchoring the pneumatic hammer to said carriage.

10. A self-supporting pneumatic hammer positioner for effortless command and control by an operator of a pneumatic hammer, said positioner comprising:

a rigid elongated template having a handle at a first end portion thereof,

a saddle mount for a pneumatic hammer mounted to a second end portion of said template opposite said first end portion thereof;

a 3-axes pivotal joint assembly mounted integral to an intermediate section of said elongated template intermediate said first end portion and said second end portion thereof; and

support means, supporting said pivotal joint assembly spacedly over ground.

11. A pneumatic hammer positioner as in claim **10**, wherein said support means includes:

an articulated boom member having an inner end portion and an outer end portion, said inner end portion pivotally mounted to said 3-axes pivotal joint assembly; and

an anchor base, said boom member outer end portion pivotally mounted about a one-axis mount to said anchor base.

12. A hammer positioner as in claim **11**, further including a lock member, releasably engaging said anchor base to counteract the moment of force generated at said boom member outer end portion relative to said anchor base, when the pneumatic hammer strikes a work surface.

13. A hammer positioner as in claim **11**, wherein said saddle mount includes:

a carriage, slidingly mounted over said second end portion of said template;

guide means, guiding said carriage for travel between first and second limit positions;

ram means, for biasing said carriage to slide to an extended operative condition intermediate said first and second limit positions thereof; and

attachment members, anchored to said carriage for releasably anchoring the pneumatic hammer to said carriage.

14. A hammer positioner as in claim **13**, further including:

second ram means, for power assist tilt displacement of said articulated boom member; and

rotational means, for rotation of said template relative to said articulated boom member.

15. A hammer positioner as in claim **11**, further including:

first ram means, for power assist pivotal displacement of said articulated boom member; and

rotational means, for rotation of said template relative to said articulated boom member.

16. A hammer positioner as in claim **10**, wherein a self-alignment bushing assembly forms part of said 3-axes pivotal joint assembly.

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